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A. Fedini

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H HOUSES (part two)

WHEREVER man has settled on the earth he has built for himself some kind of shelter. In this building he has used the materials nearest at hand, and these, quite naturally, have influenced the design and the appearance of the house. Besides materials, climate, religion, and social customs have influenced the house builder.

In the previous article on Houses we saw how houses in Britain had changed through the ages, and the same is true of many countries, particularly those in the West. But in the East, and in less advanced parts of the world, traditional ways of building are still used – either because they have proved ideally suited to the country or because their exponents are not aware of modern techniques. The spread of knowledge and technical skills means that Western-style houses are being built all over the world, side by side with those built to a pattern used for many centuries.

The Muslim house

The architectural style of the Middle East is known as Muslim, a name used to describe the followers of the Prophet Mahomet. Many houses in this style are built around a courtyard. The openings on to the street are few and are strongly barred.

Muslim houses are invariably washed in white to reflect the rays of the sun. Sometimes they are decorated with marvellous geometrical patterns, but never with representations of living creatures, for this is expressly forbidden by the *Koran*, the sacred Muslim scriptures.

Provision is always made in Muslim houses for the women of the house to move about the premises unobserved by strangers.

The African hut

In parts of Africa primitive huts like this are still built – a striking contrast to the European-style buildings of the larger towns and cities. These native huts are usually circular, with walls of baked mud reinforced by wooden stakes. The roofs, supported by central poles, are thatched over with local vegetable materials, such as savannah grass. These huts, of course, vary from region to region.

Previous page: (above) Japanese house
(centre) Igloo
(below) Modern seaside house

The Chinese house

Chinese houses are almost invariably only one storey high. They consist of a strong wooden frame set on a stone foundation. This frame supports the entire weight of the gaily tiled roof, for the walls consist merely of delicate tracery.

The house of an ordinary citizen was for many years limited by law to three bays. The three rooms within the bays were used for the reception of guests, for eating, and sleeping (in modern terms: 'two recep., one bed').

The Japanese house

The traditional Japanese house is usually made of wood, for timber is plentiful; and since timber is resilient, it withstands the earthquakes to which Japan is subject far better than bricks or stone.

The size and shape of the rooms in a traditional Japanese house are determined by the mats which are used to cover the whole of the floor. Each mat is 6 feet long and 3 feet wide, and so the length and breadth of each room must be some multiple of these measurements.

The partitions between the rooms in a Japanese house are light and can be moved about, within the limitations imposed by the mats, to give rooms of different shapes and sizes.

The Russian house

The traditional Russian house is very easy to recognise. A utilitarian ground floor, the domain of the men of the family, supports a lighter first floor for the women's quarters. This is reached by an outside stairway.

The roof is built in a characteristic shape and is crowned with a decorative (sometimes onion-shaped) tower; the outside is gaily painted.

U S S R economy

THE USSR, or Union of Soviet Socialist Republics, is the largest country in the world, occupying one-half of Europe and a third of Asia. Within its borders, stretching from Poland to China, live over 220 million people – Russians, Ukrainians, Byelorussians, Uzbeks, Tatars, and many more.

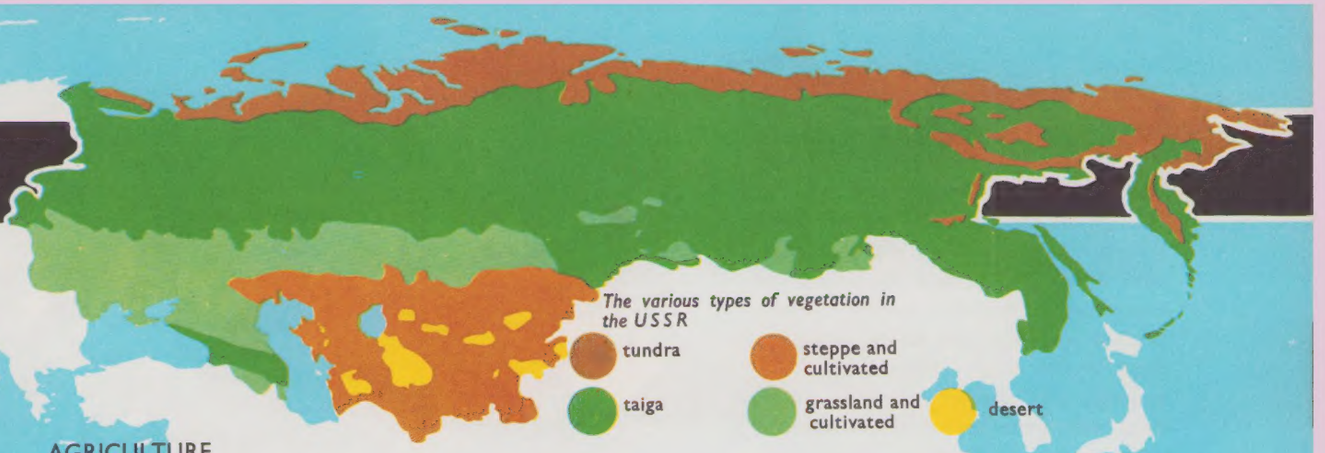
The Soviet Union now has one of the richest and most rapidly growing economies in the world. From being relatively backward and primarily agricultural in 1917, when the Communists came to power, the country has made colossal strides in all spheres of economic activity, and particularly in heavy industry.

STATE CONTROL

The state owns the land, factories, machines, and mills; the state decides what goods should be produced and what prices should be charged; it has a complete monopoly of foreign trade; in short, the state controls the economy.

Since 1928 the government has drawn up a series of Plans, each lasting for five, six, or seven years, in which the targets of output for agriculture, industry, and every other branch of the economy are laid down. Priority has been given to the self-imposed task of overtaking the industrial economies of the United States, Britain, and other rich non-Communist countries in the shortest possible time. Hence the Plans have concentrated on expanding vital basic sectors of the economy such as coal, oil, iron, heavy machinery, and engineering.

The present Seven Year Plan, 1959–1965, is part of a longer Plan which envisages that within the next 12 years the Soviet Union will have overtaken all its rivals and have the most prosperous economy in the world.



AGRICULTURE

The immense variations of soil, climate, and other natural conditions within the vast territories of the Soviet Union allow for the production of nearly all types of agricultural goods, except certain tropical ones. Grain, potatoes, sugar-beet, animal products, tea, citrus fruits, cotton, rice – all these and more can be grown on lands stretching from the harsh Baltic areas to sub-tropical Georgia.

HOW THE CULTIVATED LAND IS USED

① grain ② plantations ③ other crops ④ grazing land

Wheat is the most important product of Soviet agriculture. The richest grain-growing areas are in the central and southern 'black-earth' belt of European Russia. But the area of cultivation is increasing continually, and, at present, large areas of virgin land in Kazakhstan are being brought under the plough. Over half the total grain-growing area is devoted to wheat; the second most important crop is rye, followed by oats and barley. Maize production has expanded greatly in recent years.

Cotton output – geared to an expanding textile industry – is also growing rapidly, the greatest centre being Uzbekistan.

It is vital that Russia's agriculture should continue to expand if she is to feed her vast population herself. But this is a serious problem, for despite the extension of cultivation, the introduction of better farm machinery, the spread of irrigation, and so on, total agricultural production still fails to keep pace with the demands created by the growth of industry.

The different crop-growing areas of the USSR

CATTLE FARMING

The Soviet Union has an immense amount of livestock. These, like the rich grain areas, tend to be concentrated in European Russia. The greatest number of pigs are found in the western part of European Russia; dairy cattle in the north; and sheep in the south-east. There are 87 million cattle, nearly 140 million sheep, and 70 million pigs.

INDUSTRIAL DEVELOPMENT

The industrial development of the U S S R has been founded on two basic factors. These are, first, the dedication with which the Russians themselves set about building factories, machines, dams, bridges, railways, and so on, after the First World War; and secondly, the abundance of natural resources which exist within the Soviet Union, coupled with an extensive transport network of canals and rivers.

Russia is said to possess over half the world's total resources of coal, oil, and manganese. The main coal-mining area is that of the Donets Basin and this, combined with the iron-ore fields of the Krivoi Rog, has made south Russia one of the most heavily industrialised regions of the Soviet Union. Vast deposits of coal are also contained in the Kuznetsk and Karaganda Basins, and iron ore is mined extensively in the Urals. In 1962 over 500 million tons of coal and 128 million tons of iron ore were mined in the U S S R. The metallurgical industry turns out enormous quantities of pig iron and steel, and the largest iron and steel works in Europe is at Chelyabinsk.

In production of crude oil Russia ranks second only to the United States; 186 million tons were produced in 1962, mostly in the Caucasus, centred on Baku, and in the Ural-Volga fields.

FOREIGN TRADE

Foreign trade is a monopoly of the state, and the government decides both which products should be traded, and with which countries. Most of Russia's trade is with other Communist countries, and although Russia needs comparatively little in the way of imports, she sometimes wishes to trade for political motives. An organisation known in the West as COMECON was formed by the Soviet Union in 1949 to promote industry and trade among certain Communist countries, and all the European Communist countries excepting Albania and Yugoslavia are members.

The proportion of Soviet foreign trade with non-Communist nations has recently increased. Oil is being sold to Italy and may soon be exported to the United Kingdom, and although normally an exporter of grain, Russia has recently had to buy Western wheat; in order to do so she has had to use up some of her precious gold reserves as she does not earn sufficient foreign currency by exporting.

Heavy industry forms the basis of the Soviet economy and accounts for over two-thirds of the total industrial production. Most of the necessary raw materials are found within Russia's boundaries – not only iron, but zinc, magnesium, aluminium, copper, barite, lead, cadmium, tungsten, manganese, graphite, bauxite, gold, silver, and many others.

Coal, oil, and electricity, as well as a growing use of atomic energy, provide the power for Russia's huge industries. Production of electrical energy now stands at over 360 thousand million kWh. Many of the power stations operate on coal, but the Lenin hydroelectric plant on the Volga near Kuybyshev is the largest in the world.

The dyke of the hydroelectric station at Kuybyshev, the largest in the world

Engineering is one of the country's most rapidly expanding industries. Each year more and more heavy machinery – turbines, electric motors, motor vehicles, and tractors – is turned out. And production of consumer goods, such as watches and clocks, televisions, radios, refrigerators, and washing machines, is also shooting up.

The output of the Soviet chemical industry is second only to that of the United States. Fertilisers, sulphuric acid, synthetic rubber, and artificial fibres are among the main products. The older centres, Moscow and Leningrad, have been joined by new ones in the Ukraine, Urals, and Siberia (see page 2267).

Timber and paper industries are widespread and highly mechanised. Forty per cent of the total area of the U S S R is covered by forests, and the largest timber centres include Arkhangelsk, Leningrad, Volgograd, and Igarka.

Textiles, especially cotton goods, are among the chief products of Russian industry. Output is expanding, particularly in the Urals and Siberia, although the Moscow region remains the most important.

The food-processing industry is extremely important, and is concentrated near large urban centres, above all Moscow and Leningrad and in the Ukraine, Central Russia, and the Volga region. Such industries include flour grinding, sugar-beet production, wine making, food canning, and meat packing.

Main exports: grain, coal, oil, cotton, butter, machinery, iron and steel, timber.
Main imports: fuel, raw materials, consumer goods, and a certain amount of food products.

FACTS AND FIGURES

Population (1963): 223 million

Principal towns (pop. 1959)
- Moscow (capital): 5 million
- Leningrad: 3·3 million
- Kiev: 1·1 million
- Baku: 968,000
- Gorkiy: 942,000
- Kharkov: 930,000
- Tashkent: 911,000

Railway mileage (1958): 76,136

Currency: 100 kopeks = 1 rouble

Major seaports
- Baltic Sea: Leningrad, Tallin, Riga
- White Sea: Arkhangelsk
- Black Sea: Odessa, Feodosiya
- Azov Sea: Rostov-on-Don
- Caspian Sea: Baku, Astrakhan
- Far East: Vladivostok

Chief rivers
- Lena: 2,648 miles
- Volga: 2,290 miles
- Ob: 2,113 miles

POPULATION IN BRITAIN

BRITAIN is one of the most densely populated countries in the world, for with 52 million people she has 567 people for every square mile of land. The only European countries with a higher density are Belgium and the Netherlands; that of France is 217, of the United States 51, and of Australia only 3.

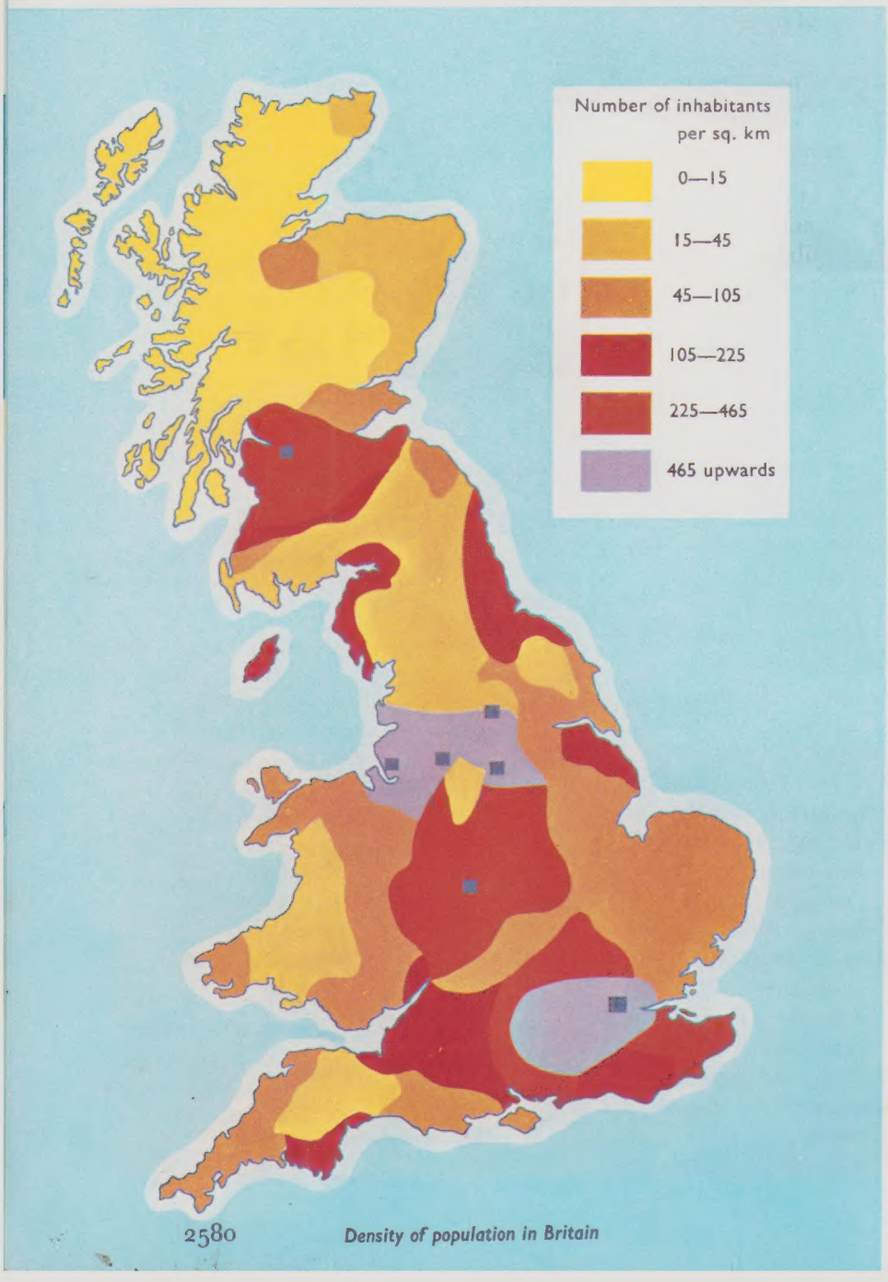
A high density of population brings problems with it – like those of feeding, housing, education, and welfare. Britain cannot produce enough to feed her inhabitants, and so has to rely on imports; moreover, despite careful planning, the urgently needed new houses are eating steadily into her agricultural land. The increasing proportion of older people is straining the existing social services, while new schools and universities battle to give the rising generation the education considered by those living in a prosperous country to be their right.

In fact, overpopulation now menaces Britain. When does this problem date from, what are the characteristics of the British population, and how are the people distributed?

Population growth

When William the Conqueror invaded England in 1066 there were perhaps a million inhabitants to greet him. Now the population of the United Kingdom is over 52 million, and most of this increase has come in the last 200 years. In the Middle Ages, increases in population were checked by deaths through epidemics, and by 1700 the population was probably in the region of 6 million inhabitants, and roughly 7 million by 1760. It was only after 1760 that the Industrial Revolution got under way, and with it came a population revolution. By 1801 the first ever census showed a population of about 10 million; 50 years later it had doubled; by 1911 it had doubled again.

What were the reasons for this growth? The answer can never really be known. The increased opportunities accompanying industrial expansion encouraged early marriages and large families; the growth of medical knowledge increased the average expectation of life; better food and housing meant a stronger, more vigorous population and the death of fewer children; great epidemic diseases were being brought under control – all these combined to bring about a population explosion which would have been impossible in an earlier age.



2580 *Density of population in Britain*

Structure and composition

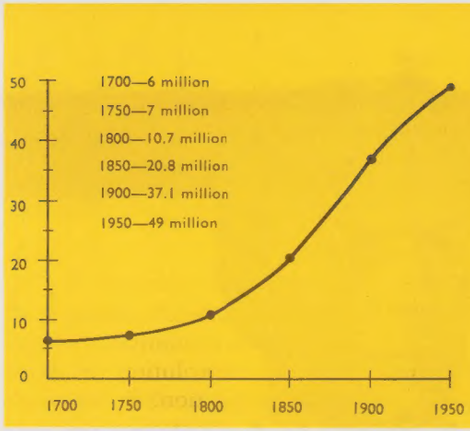
During the last century the population contained a high proportion of young people, with the proportions getting smaller for each succeeding age group, until relatively few lived beyond the age of 65. Today, however, one person in eight in Britain is over 65. One reason for this is that people are living much longer. The improvement in medical knowledge and techniques and also in living standards has meant that, whereas in 1900 a man could expect to live until the age of 48 and a woman until 53, the respective ages today are 68 and 74. Another reason is that the birth rate is considerably lower than it used to be, despite the post-war 'bulge' (a temporary rise in the birth rate). In the middle of the last century families of six, seven, eight, or more were quite normal; now they are rare, and the average number of children to each family today is between two and three.

Because boys tend to be weaker at birth than girls, more of them die at a very young age; and also because wars have taken toll of so many men, there have always been more females than males in Britain. But medical skill is lowering infant mortality and the gap is closing; at present, the ratio is 1,086 women for every 1,000 men.

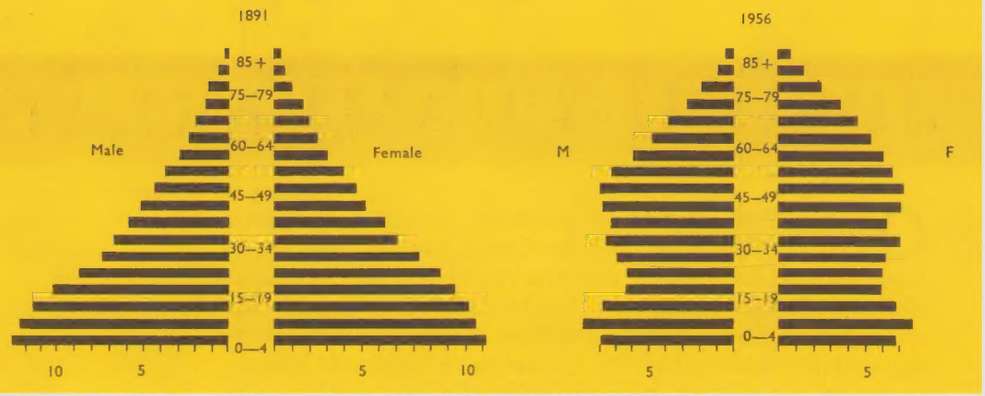
Regional differences and urbanisation

The population of Britain is by no means spread evenly throughout the country. Some areas, such as the Scottish highlands, the Welsh mountain districts, and the moors of Yorkshire and Devon, are very sparsely populated. Most purely agricultural areas, too, have a relatively low population density. On the other hand, several parts of the country are extremely thickly populated. The populations of Birmingham and Glasgow are both over one million, while one in every six English people live in the London area.

The concentration of British population in certain areas is, above all, associated with the expansion of a number of great cities. Britain is an industrial nation; indeed, one of the most industrialised in the world. And industry of all kinds is, on the whole, carried on in or near towns. Since two-fifths of the labour force in Britain is engaged in manufacturing, much of her population lives in towns, and these grow not only as industry expands, but as retailing, entertainment, personal services, and other occupations are called forth by the needs



Growth of British population



Age groups of British population

of these growing urban communities.

This concentration of population is not confined to the towns and cities alone. In many cases houses have to be built farther and farther from the town centre, so that 'conurbations' outside actual town boundaries have grown up. Often these conurbations adjoin neighbouring towns, so that a continuous area of heavily populated land is created. Thus, for example, $4\frac{1}{2}$ million people live within a 25-mile radius of Manchester. The country's most densely populated regions are Greater London, Greater Glasgow, Merseyside, Greater Manchester, Greater Birmingham, the Black Country, and Tyneside. About half the total population of Britain live in these seven areas.

This development of towns has its counterpart in the relatively small numbers engaged in agriculture, partly due to increased mechanisation. A century ago, about one person in five worked on the land; now the figure is roughly one in 25. While the phenomenal growth of London and Birmingham is of concern to town-planners and politicians, many small rural villages are finding their populations dwindling, as the lure of the Big City attracts the fortune-seekers and the ambitious.

THE CHIEF BRITISH CITIES

	Population (1961)
London	8,171,902
Birmingham	1,105,651
Glasgow	1,054,913
Liverpool	745,810
Manchester	660,300
Leeds	510,597
Sheffield	494,650
Edinburgh	474,062
Bristol	436,440
Belfast	433,900
Nottingham	311,645
Coventry	305,060
Hull	303,268
Bradford	295,768

The drift to the South

The Industrial Revolution was firmly based on the North. It was in the Lancashire cotton mills, the Yorkshire woollen mills, and the coalfields of Northumberland and Durham that the foundations of British industrial greatness were laid. And with the growth in population brought by the growth of industry, towns like Manchester, Leeds, Bradford, Bury, Newcastle, and Glasgow all expanded rapidly, far outstripping the average rate of growth of the entire population.

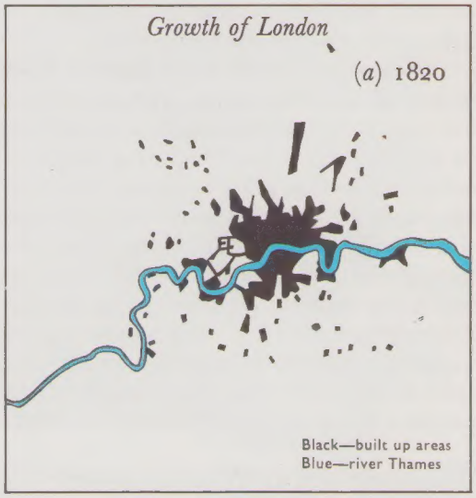
In about the 1870s the picture began to change, and the industrial areas in the Midlands, South, and South-East began to grow the fastest. New industries, such as bicycle manufacture, and, later, motor-car manufacture, electrical engineering, chemicals, and synthetic fibres, were established largely in these southern districts.

The process has continued, and a greater and greater percentage of the population is living in the Midlands and the home counties. Above all, London has expanded. Always by far the largest British city, it now has nearly eight times as many inhabitants as its nearest rivals – Birmingham and Glasgow.

The South, with its rapidly growing population, expanding industries, and building boom, is therefore presenting something of a contrast to the northern areas, particularly to Scotland, Northern Ireland, and the North-East. South Wales, too, once one of the centres of industrial growth, is now being by-passed by present trends.

The declining industries of these regions, coupled with a high level of unemployment, have induced the government to take active steps to encourage the growth of new industries there, and discourage expansion in the congested cities of the South.

Britain is now facing a problem which has become increasingly evident in the last ten years – the much publicised drift to the South.



The increasing population and the enormous growth of certain towns in the Midlands and the South have led the government to try to disperse the population by creating a number of completely new towns. These include:

	pop. (1961)	*date of designation*
Hemel Hempstead	62,800	1949
Harlow	61,000	1947
Basildon	59,000	1949
Crawley	58,000	1947
Stevenage	50,200	1946
Corby	41,000	1950
Welwyn G. C.	37,100	1948
Cwmcran	32,000	1949
Bracknell	23,000	1949
Hatfield	21,700	1948
Peterlee	14,500	1948
Aycliffe	14,000	1947

JOSEPH CHAMBERLAIN

ONLY a very important politician can split his party. Peel did it in 1846 over the Corn Laws (see page 2600); Lloyd George did it during the First World War when he broke with Asquith and took most of the Liberals with him (see page 2382). Joseph Chamberlain did it twice. He split the Liberals by opposing Gladstone, and the Unionists by opposing Balfour. In fact he was probably the most able politician who has never become Prime Minister. And during the last years of the 19th century and the opening years of the 20th his was the most influential voice in British politics.

Chamberlain was born in London on 8th July 1836, the son of a wealthy industrialist. But the city with which he was to link his name was not London but Birmingham, where in 1854 he joined a screw manufacturing firm as a representative of his father's interests. He was so successful in business that, at the age of 38, he was able to retire with a fortune of £100,000. By this time he had become famous not only in Birmingham but throughout the country for his progressive campaigning on education and on social welfare. He had become Mayor of Birmingham in 1873, and in the succeeding three years his untiring efforts with regard to improvements in health, sanitation, parks, public buildings, and slum clearance revolutionised people's thinking about local government.

Chamberlain at Westminster

In 1876 Chamberlain was elected MP for Birmingham. In Parliament he quickly made his mark and was soon regarded as a 'coming man' in the Liberal Party. Gladstone himself (see page 1636) distrusted 'radicals' like Chamberlain, but he needed the support of the radicals in his ranks. In 1880 both Chamberlain and his great friend Sir Charles Dilke were invited to join Gladstone's new ministry. Chamberlain joined the Cabinet as President of the Board of Trade. During the six years of Gladstone's premiership Chamberlain took an active interest in education, foreign and colonial policy, and of course in the most important issue of the time – Ireland.

Chamberlain was a bitter opponent of Home Rule for Ireland, yet he was no supporter of the coercion used by the government to deal with the rebellious Irish (see page 1484). His solution was for Ireland to remain part of the United Kingdom but to be largely self-governing through a vastly extended system of *local* government. Chamberlain played a great part in the Kilmainham Treaty (1882) by which Parnell agreed to stop 'outrages'.

But Gladstone had his sights firmly fixed on Home Rule for Ireland, and when he introduced his first Home Rule Bill in 1886 Chamberlain resigned from the government and voted against it. At the general election Chamberlain was triumphantly re-elected at the head of 78 'Liberal Unionists' who were also opposed to Gladstone's Home Rule proposals. Chamberlain now ranged himself with the Conservatives (who were, of course, Unionists – that is, they supported the Union of England and Ireland). In 1895 he became Colonial Secretary in Lord Salisbury's Conservative government.

Chamberlain's term at the Colonial Office was one of the most important periods in the history of the British Empire. For he was devoted to the idea of a united empire and sought to strengthen imperial ties everywhere. He did much for the administration of Australia, while his policy of developing the 'black colonies' in Africa did a great deal both for them and for home manufacturers who exploited the growing markets.

Joseph Chamberlain (1836–1914); *disrupted two political parties*

During the Boer War Chamberlain, virtually alone, rallied his country in the face of almost universal hostility. At the same time he criticised British foreign policy and rejected the 'splendid isolation' programme of his predecessors. Instead, he advocated unsuccessfully that Britain should go into an alliance with Germany and the United States.

The Unionists are split

Out of Chamberlain's imperialism came a split within the Unionist movement (Conservatives and Liberal Unionists). Chamberlain wanted to strengthen the empire by lowering trade tariffs in the empire and raising them against foreign countries. After all, he pointed out, Germany and the United States had tariff barriers against Britain. Yet the great majority of British economists at this time were 'free traders', and in 1903 Chamberlain dropped a bombshell; he resigned from the government and campaigned privately for his policy of 'imperial preference'. He succeeded in winning over most of the Liberal Unionists to his 'protectionist' policies, and this split did much to ruin the government, which was now under the leadership of Balfour. In 1905 Balfour's party was overwhelmingly defeated, and in the course of the election campaign Chamberlain himself found a formidable opponent in Herbert Asquith who followed him about the country answering, as a free trader, Chamberlain's protectionist speeches.

Chamberlain was now 70 years of age, and suddenly his career was cut short. Shortly after the general election of 1906 he had a severe stroke. He lingered on as an invalid until 1914, but his Parliamentary career was finished.

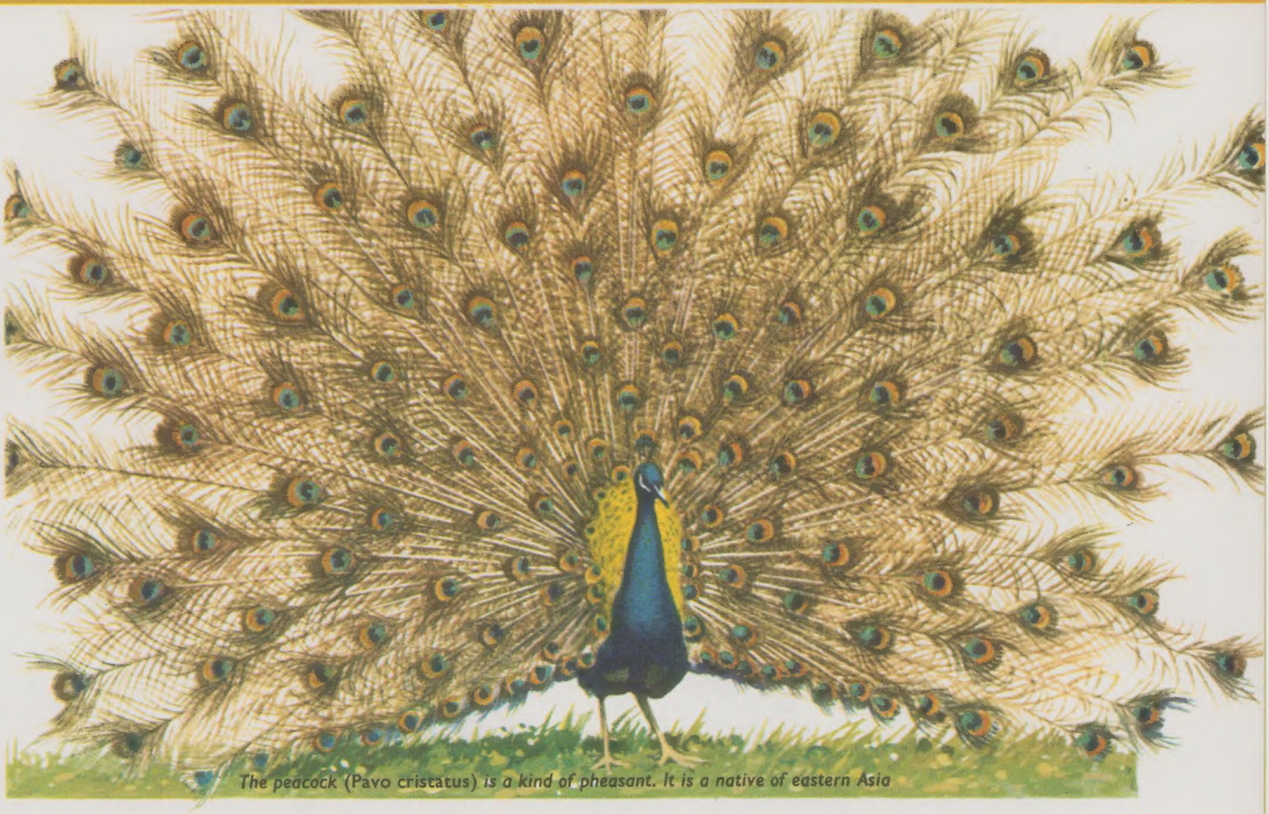
Chamberlain's legacy to Britain was great. He gave her empire a new pride and a new sense of purpose. And although his vigorously independent spirit cannot be said to have found many imitators in British politics, at least the history of British politics is the richer for him.

YOU SHOULD NOW KNOW

1. *Of which city was Chamberlain Mayor?*
2. *When did he enter Parliament?*
3. *What was his solution to the Irish Question?*
4. *When did he become Colonial Secretary?*
5. *On what issue did he break with Balfour?*

THE GALLIFORMES

ON average, every single person in Britain ate 250 eggs in 1962, which adds up to a total of rather over thirteen thousand million eggs. During the same period about 343,600 tons of poultry were eaten. You can see from these figures how great a part the domestic fowl plays both in the diet and in the economy of the nation. Moreover, the same is true of practically every country in the world. The fowl or chicken, and other domesticated birds such as the turkey and guinea fowl, belong to an Order of birds called the Galliformes. In addition to the few that have been domesticated there are many wild species; some of them, such as the peacock and the brilliantly coloured pheasants, are among the most beautiful of all birds.



The peacock (Pavo cristatus) is a kind of pheasant. It is a native of eastern Asia

Jungle fowl (*Gallus gallus*)

JUNGLE FOWL (*Gallus gallus*). This bird is found commonly in the wild state in eastern Asia, and is believed to be the ancestor of all the domestic breeds (see page 214). The hen jungle fowl has barred brown plumage.

CHARACTERISTICS OF THE GALLIFORMES

The Galliformes are sometimes called the game-birds, because many of them, such as pheasants, partridges, and grouse, are a favourite quarry of sportsmen. Most of them are ground birds, and good runners, with strong feet and legs. The feet have three toes pointing forward and one backward, with strong claws which the bird uses to scratch among leaves and loose soil for food. The males often have horny spikes on their legs called spurs, which are used in fighting. Some species are polygamous (having several 'wives'), and the males usually play no part in incubating the eggs or bringing up the young. The sexes are nearly always very distinct in appearance. The males usually have gay plumage, while the females are generally patterned in brown to match the fallen leaves among which they nest. Their wings are short and rounded. Yet although they spend most of their time on the ground, many game-birds are swift, powerful flyers. Most of them, however, seldom fly far. They are found on all the continents, except Antarctica, and range from the tropics to the Arctic regions.

CLASSIFICATION

Families of the Galliformes:

Tetraonidae: Grouse, ptarmigan, capercaillie. Found mainly in northern pine forests of Europe, Asia, and America.

Phasianidae: Pheasants, partridges, quails. Widely distributed, mainly in Asia.

Meleagridae: Turkeys. Two wild species, in southern North America.

Numididae: Guinea fowl. A number of species, all native to Africa and Arabia.

Megapodidae: Brush turkeys. Confined to Australia and New Guinea.

Cracidae: The curassows of South America.

Opisthocomidae: The hoatzin. A very strange bird, difficult to classify but best regarded as one of the Galliformes.

SOME SPECIES OF GALLIFORM BIRDS

PTARMIGAN (*Lagopus mutus*). The ptarmigan is an Arctic-Alpine bird; that is, it lives both at sea level in the far north, and high in the mountains in southern regions. In Scotland it inhabits mountains above 2,000 feet. In summer it is brown with white wings and underparts, but in winter it camouflages itself by turning white to match the snow.

HAZEL HEN (*Tetrastes bonasia*). Although it is not found in Britain, the hazel hen is widely distributed in Europe, including eastern France. It lives mainly in forests with thick undergrowth, and is the smallest member of the grouse family.

BLACK GROUSE (*Lyrurus tetrix*). The male is a beautiful bird with the tail forked in a 'fish-tail' shape. It is found in northern Asia and Europe, including Scotland, and lives in woods and moorland.

QUAIL (*Coturnix coturnix*). The quail looks like a very small partridge and is found all over Europe but only rarely in Britain. Quails are unique among the galliform birds in being true migrants. All those which breed and spend the summer in Europe fly to Africa for the winter, returning in the spring. The quails, of which there are several species, are the smallest of all the Galliformes.

PARTRIDGE (*Perdix perdix*). This is a common bird found all over temperate Europe and Asia. Partridges thrive well on cultivated land and live in family parties called *coveys*. The male is exceptional among galliform birds in helping to guard and feed the chicks after they hatch.

CAPERCAILLIE (*Tetrao urogallus*). Capercaillies were once native to northern Britain but became extinct in about 1760. Early in the 19th century they were reintroduced to Scotland from Sweden and are still well established there. The capercaillie is one of the largest of the galliform birds; it is found in pine and fir forests in Europe and northern Asia.

Note: the illustrations are not drawn to a uniform scale

THE COMMON PHEASANT (*Phasianus colchicus*) is a native of western Asia and was probably introduced to Britain in Roman times. Some of the Asiatic species, such as the golden pheasant (*Chrysolophus pictus*), are most beautiful birds.

Golden pheasant

TURKEY (*Meleagris gallopavo*). Wild turkeys are found in mountain forests in the southern United States and Mexico. They were introduced into Europe and domesticated over 400 years ago. Another species, the ocellated turkey, lives in Central America.

GUINEA FOWL (*Numida meleagris*). In the wild state this bird lives in Africa and Arabia. Domesticated guinea fowl generally live free on farms and often roost in trees; they do not become as tame as other poultry. Several other species of guinea fowl are found on the African continent.

HOATZIN (*Opisthocomus hoatzin*). This strange bird lives in northern South America in swamps and along rivers. It nests in low trees, and the chicks are active soon after hatching; they have claws on their wings which enable them to climb about among the branches. The adult has only weak powers of flight.

ARGUS PHEASANT (*Argusianus argus*). This beautiful bird may have a total length of 6 feet, of which 4 feet is tail. The wing feathers are ornamented with spots looking like eyes. Argus pheasants live in the rain forests of Malaya and Sumatra; the males put on a remarkable courtship display.

HOW TO READ A WEATHER MAP

EXPLANATION OF SYMBOLS

CLOUD

SYMBOL	CLOUD AMOUNT
○	cloudless
⊖	1/8th of sky covered
◐	2/8ths of sky covered
⊖	3/8ths of sky covered
◍	4/8ths of sky covered
⊕	5/8ths of sky covered
◍	6/8ths of sky covered
◍	7/8ths of sky covered
◍	sky entirely clouded — overcast.

WEATHER

Symbol	Weather
=	Mist
≡	Fog
,	Drizzle
•	Rain
★	Snow
⋮	Rain Showers
⚡	Thunderstorm

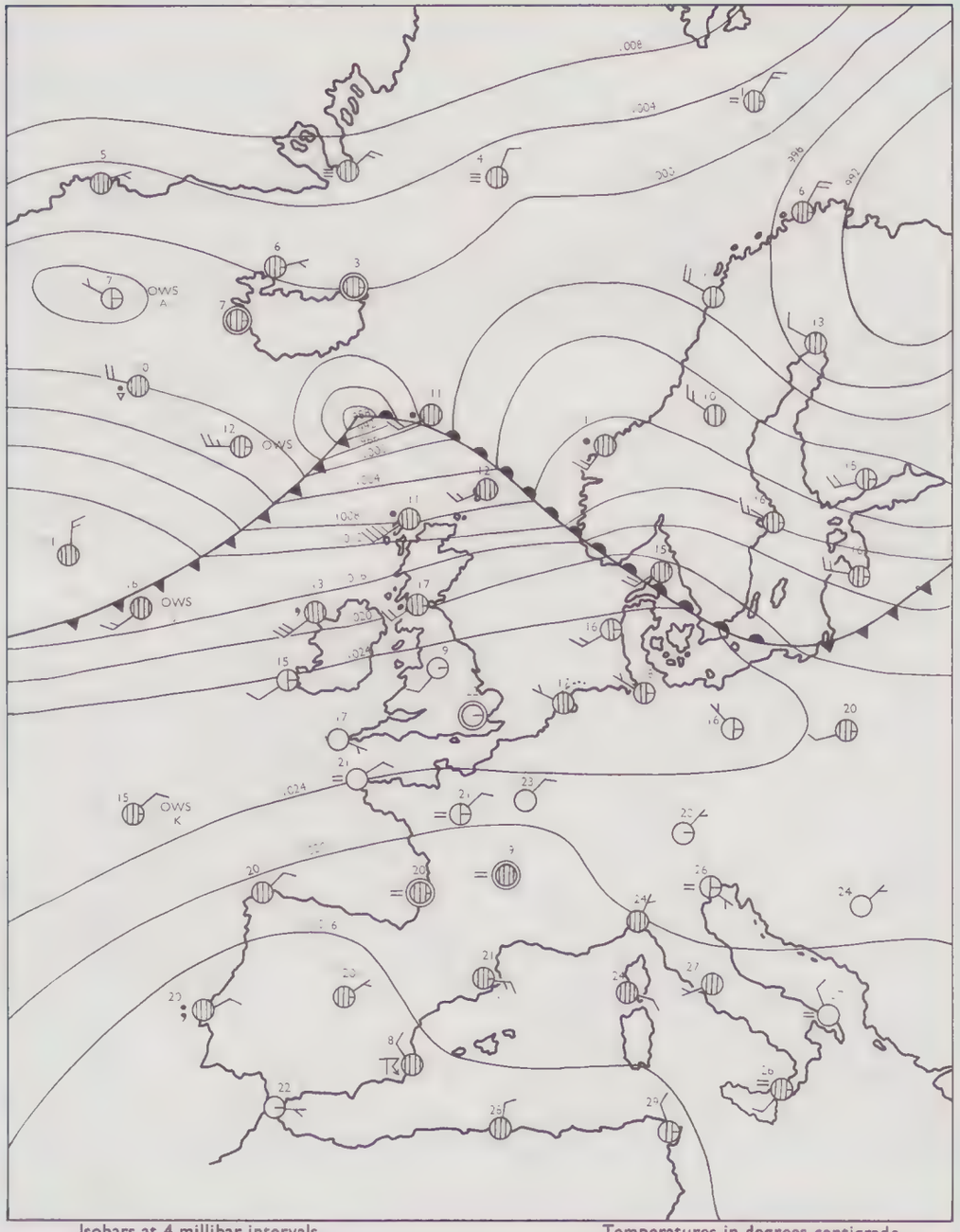
WIND

◎	Calm
	1–2 knots
	3–7 knots
	8–12 knots
	13–17 knots

For each additional 5 knots add one half feather up to :

	48–52 knots

WEATHER MAP OF WESTERN EUROPE FOR 1200 HOURS ON 15TH SEPTEMBER 1963



Isobars at 4 millibar intervals

Temperatures in degrees centigrade

Cold Front

Warm Front

OWS A
OWS I
OWS J
OWS K

Weather Ships

IT was a stormy June day in 1944. All night long a group of tense, anxious men had been poring over maps and charts spread in front of them – not ordinary maps, but weather maps; and from these they were going to advise on one of the most vital decisions in world history – whether the Allies could launch their long-planned invasion of Normandy and begin D-Day. As the weather reports coming in changed, so the maps were redrawn, and at last they had good news – not perfect, but good enough. The weather forecast improved and D-Day began on 6th June, the last possible day in that month.

Not only in war, but in everyday life, weather reports are of the utmost importance: for it is from them that weather forecasts are made. If you learn how to read a weather map skilfully you can tell in the morning whether it will be fine in the afternoon and even whether another rainy spell is coming tomorrow. And by getting information from your local meteorological station and plotting your own maps you can often be 'one up' on the radio forecast, which necessarily takes in a wider region than your own home town.

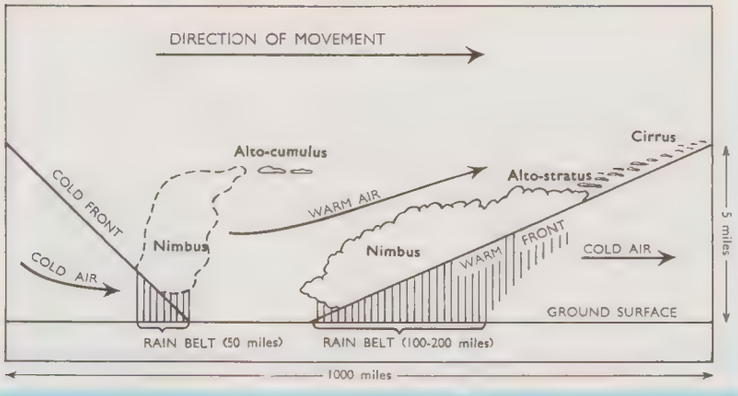
HOW WEATHER MAPS ARE MADE

Just as a topographical map represents the features of the landscape by a series of conventional signs, so the weather maps show the features of the atmosphere at one particular time in a symbolic form. British weather maps are compiled from reports sent by teleprinter and radio to the forecasting headquarters of the Meteorological Office at Dunstable. Each recording station makes observations of the weather at 0000 hours (midnight), 0600 hours, 1200 hours, and 1800 hours G M T each day, although at certain stations observations are made every three hours, or even every hour.

All the observations are sent to the forecasting office by a numerical code, an example of which is: 772 00000 15050 22913 00000 11806. The first three figures are the identification number of the station, which in this case is London Airport. The next group of five figures refers to the total amount of cloud and the wind speed and direction. Our example reports calm, cloudless conditions. 15050 refers to visibility, present weather, and the weather since the last observation. The next group indicates atmospheric pressure and temperature. Cloud at different levels is described in the next group; the dew point and barometric tendency are described in the last group of symbols. The figures for British stations are printed on the back of the *Daily Weather Report* published by the Meteorological Office. From this a great deal of information can easily be obtained about atmospheric conditions.

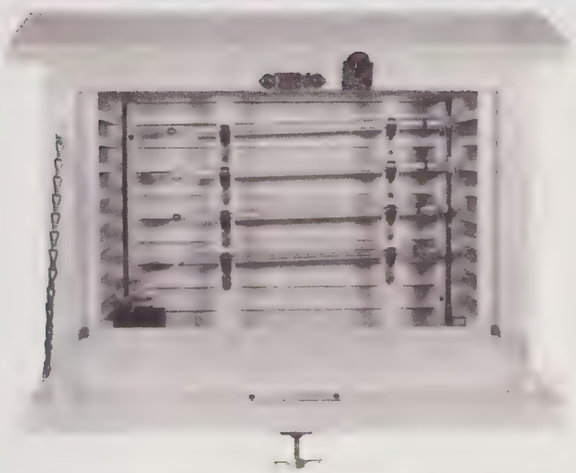
Diagram to show how depressions arise where warmer and colder air masses meet

Fig. 2 VERTICAL SECTION THROUGH A DEPRESSION



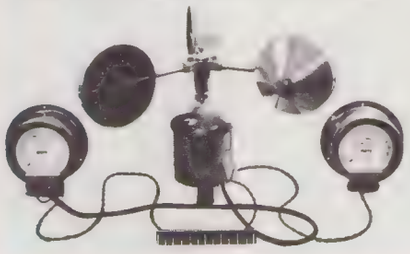
FILLING IN THE DETAILS

On the forecasters' charts all this information is shown in and around the position of the station. But on the published maps (one is shown on the left) only cloud amount, wind force and direction, and the weather at the time of observation are shown. Thus London on our map is shown to have one-eighth cloud cover, a temperature of 22°C, and be calm; whilst Stornoway in the Hebrides has a complete cloud cover, a gale-force south-west wind, rain, and a temperature of 11°C. The pressure on the barometer is shown by *isobars* joining places with equal atmospheric pressure (see page 939). An area of high pressure, or anticyclone, is shown over England and Germany, with fairly clear skies, light winds, and warm temperatures. In southern France symbols show mist which often forms in these conditions. (During winter an anticyclone can bring clear cold weather or even overcast conditions.) North of Scotland is an area of low pressure, or depression, as it is usually called. Winds blow into the depression (in a spiral anti-clockwise motion in the Northern Hemisphere), because it is a region of low pressure, and winds move from areas of high pressure to 'lows'. Depressions begin at the boundary of warmer and colder air masses, where the lighter warm air is lifted up over the denser cold air. The boundaries of these warmer and colder air masses are called 'fronts'.



Stevenson screen; double-louvred (arrangement of overlapping boards) box to give ideal conditions for exposure of meteorological instruments

A cup generator anemometer; it measures wind speed by the speed at which its cups rotate



A barograph for measuring and recording atmospheric pressure

WARM, COLD, AND OCCLUDED FRONTS

Two types of front are shown on our map: a warm front with warm air over-riding cold air, and a cold front with cold air undercutting the warm. Another type of front is the occluded front where the warm air has been completely lifted off the ground. The depressions with their fronts generally move from west to east across northern Europe. A definite weather sequence is associated with the passage of the fronts. First, as a warm front approaches, wispy cirrus clouds (see page 410) develop which gradually lower to alto-stratus and then to nimbus, from which rain falls over a wide belt (see fig. 2). As the front passes, temperature rises, and the rain turns to drizzle and stops. The warm air sector of a depression is often overcast with alto-cumulus cloud. As the cold front passes, the temperature drops abruptly, the wind direction changes, and there is a narrower, showery, perhaps thundery, rain belt.

The successive observations made by meteorologists make it possible to follow the movements of the depressions with their weather changes, and (with experience) to predict their future movements. Reading the weather map is the first step in this procedure which enables the forecasters to predict the weather fairly accurately for the next 24 hours.

FORESTRY

THIS copy of *Knowledge* began in a Scandinavian forest – for paper comes from wood. Look around you and see how many other things are made from timber.

Forests cover about 20 per cent of the earth's land surface, varying from the hundreds of miles of thickly forested land in places like Siberia, Canada, and Burma, to small areas of woodland which have been planted as recently as this century. For man has to face an urgent problem – the replacement of the many millions of trees which he cuts down each year.

Not only do trees provide us with timber; their roots hold down soil which might otherwise be eroded by wind and water. In America great tracts of land are now desert, for the forests which once grew there have been destroyed, and wind and water have removed the soil. And forests provide a home for many kinds of wild life. It is essential that they should not be wiped out; and the responsibility of providing trees for the future lies with the forester.

The forester's work is called forestry. He seldom sees the final results of his labours, for even rapidly growing trees take about 40 years to mature, and those that grow more slowly take several centuries. The forester who plants an acorn never lives to see the mature oak tree; he is really working for the benefit of future generations.

The Giant Redwood, Sequoia sempervirens, *a native of California. This species has been introduced into most temperate countries, where it is expected to give high yields of timber*

FOREST MANAGEMENT

Forest trees are usually grown from seed in a 'nursery'. The ground is carefully prepared, and, in consequence, a high proportion of the seeds germinate. It is also easier to protect the young plants from attack by rabbits, deer, and sheep in a nursery. When the plants are one or two years old they are removed from the seed-bed and transferred, either to another part of the nursery for a further one or two years, or to the plantation where they will spend the rest of their lives.

During the first few years in the plantation it may be necessary to cut the weeds away so that the young trees are not smothered. But the trees soon grow large enough to take care of themselves, and the shade that they cause is sufficient to keep the ground around them reasonably clear of weeds.

After the trees have been growing for about 15 years the crop is 'thinned'; this operation is repeated at intervals until the trees reach maturity. Many different thinning systems are used, but almost all involve removing the smaller and less well-shaped trees, thus leaving more room for the best and the most valuable specimens. The 'thinnings' are of less value than mature wood, but they can be sold; the money that they bring in goes towards the cost of running the woodland.

The final operation is the felling of the mature trees and the extraction of the logs. These are transported to the sawmill where they are cut into timber of the required shape.

PRUNING

Each species of tree matures in its own way. Unfortunately, this natural growth does not always produce the timber with the greatest market value, and so it is sometimes necessary to control the shape and growth of trees by pruning.

The method of pruning employed depends on the kind of tree and on the purpose for which the timber is destined. Thus, in some cases, the whole of the top of the tree is cut off; in others, only the lower side branches are removed.

Coppiced tree, cut to the ground

Pollarded tree, with top removed

Brushed-up tree, with its lower branches removed

The strange appearance of these sweet chestnut trees is the result of coppicing in order to produce poles for use as gate-posts, and hop poles, and for manufacturing chestnut paling

Hardwoods and softwoods

Hardwood is the term used in forestry for those trees which, like the oak, the ash, the sycamore, and many others, have broad leaves. In general these trees produce a hard, durable kind of timber, though this is not invariable. For example, the birch is a broad-leafed tree but has wood which is quite soft. The broad-leafed trees are known to botanists as Angiosperms and they are, with few exceptions, deciduous.

The quality of the timber formed by hardwood trees depends largely on the rate at which the trees grow. Trees which stand on good land and which have a plentiful water supply grow rapidly and tend to produce light, resilient timber. Slow-growing trees produce closer-grained wood which, though tough, is inclined to be brittle. Hardwood is used particularly in the manufacture of furniture.

The *softwoods* are those trees which are usually known as firs or conifers. Among them are the Scots fir, the spruce, the larch, the cedar, and the North American Douglas fir and sequoias. These trees have foliage which is needle-shaped, and, with the exception of the larch, they are evergreens. They are known to the botanist as Gymnosperms.

Except for the timber of the larch, which is relatively hard, the timber of the softwood trees is light and easily worked. It is used chiefly when a smooth finish is unnecessary. Much softwood is used for making wooden containers, and, in houses, for rafters, joists, and flooring. In addition there is a great demand for certain softwoods for pulping and paper manufacture, particularly for newsprint.

1. COPPICING

This is the practice of cutting a tree right back – to just above ground level. New shoots grow from the stump (see illustration, left); and in a few years these shoots develop into strong poles which can then be felled.

Not all types of tree will withstand pruning as rigorous as this; ash, willow, and sweet chestnut (above) respond well to this treatment, and send out a number of new shoots.

After the poles have been felled a further cluster of shoots will spring out from the same stump. And the process can be repeated again and again.

2. POLLARDING

Pollarding is a pruning method in which only the top part of a tree is removed. Ornamental trees are often pollarded to prevent them from growing too high. Pollarding is carried out on willow trees for commercial purposes; the new slender, pliable shoots that grow out of the top can be used for fences and hurdles.

Pollarding at a height of 8 to 10 feet from the ground also protects the new shoots from damage by livestock.

Visitors to Charnwood Forest may have noticed the oak trees there – pollarded in memory of Lady Jane Grey.

3. BRUSHING UP

Brushing up is a form of pruning in which the lower branches are removed from a tree (see illustration, left). This improves the quality of the mature wood and also makes it easier for men and vehicles to pass through the woodland.

To obtain the best results from brushing up it is important that the branches should be cut off as close to the trunk as possible. In this way 'snags', or protruding stumps, can be avoided, so that when the bole (or tree-trunk) reaches maturity it has fewer irregularities and is correspondingly more valuable.

ENEMIES OF THE FORESTER

Young trees are soft and succulent, and make tempting food for many animals. Nurseries are therefore often surrounded by netting to keep out rabbits, deer, and sheep. Squirrels are also a nuisance, although they tend to attack the older trees. Their habit is to stand on the branches and to tear the bark off the nearby tree-trunk in order to reach the wood beneath. As a result of their activities the upper parts of the tree are weakened and scarred. The most serious pests of woodland are various kinds of insects. Some eat the leaves and young shoots; most of these are caterpillars of moths. Others, mainly larvae of beetles, burrow in the wood or under the bark.

Apart from animal pests the forester has also to contend with the weather. A severe winter can seriously damage, or even kill, young trees, while late frosts can kill new shoots. Strong winds may blow down even the finest tree if its root-hold is poor, and snow, followed by wind, can bring many acres of woodland crashing to the ground.

EDWARD I

THERE is no such king as 'Edward the Great', yet Edward I has as much claim to greatness as any mediaeval king. After the calamitous reign of John (1199–1216; see page 374) and the de Montfort revolt and civil war under Henry III (1216–1272; see page 1956), England needed a strong, able, even a glamorous king. And Edward was in many ways the ideal mediaeval sovereign. He was tall and powerful, with fine features and a royal bearing. He was a splendid swordsman and horseman, and a lover of tournaments and pageantry. Above all, his commanding personality inspired respect and admiration, and even his impetuous and undisciplined temper did not get him into difficulties until near the end of his reign.

When Henry III died his son Edward was in Sicily on his way back from a Crusade. He did not hurry home but instead made a leisurely journey through Italy and France, where, because he was Duke of Aquitaine, he did homage to the French king for his possessions in France. He also pacified an outbreak of lawlessness in Gascony. Edward did not arrive back in England until the summer of 1274 and was crowned in Westminster on August 22nd.

'The Great Lawgiver'

Edward was very much the 'King of England'. He extended royal authority and tried to ensure that all the business of state came through him personally and his officials. One of the great successes of his reign was the spectacular increase of the area in which the king's law operated, and also the growth in its effectiveness, so that in every corner of the realm people felt themselves to be under the firm, but protective, hand of the king.

As soon as he arrived in England, Edward ordered a general inquiry into the numerous regional 'franchises' and 'liberties' by which local lords had obtained special privileges. Edward's inquiries were known as the *Quo Warranto* ('by what warrant?') proceedings; he sought to prove that many local privileges were not valid, and had not been granted by Royal Charter.

Provisions to extend the king's influence and to collect all the aids and dues to which he was entitled were included in two Statutes of Westminster (I in 1275, II in 1285), the Statute of Gloucester (1278), and the Statute of *Quo Warranto* (1290). In addition these Statutes sought to improve the efficiency of justice and to eliminate corruption among the king's officials. Edward was particularly concerned with the complicated system of land tenure; by the famous *De Donis Conditionalibus* clause in the Statute of Westminster II he laid down that if a landowner died without heirs the land was to return to the original donor. By the Statute of *Quia Emptores* (1290) Edward greatly simplified the feudal system by decreeing that if B held land from A, B could not let it to C without dropping out of the chain; thus C would hold the land directly from A. Other important Statutes were: Mortmain (1278), by which Edward tried to prevent property falling into the hands of *corporations* like the Church – a corporation never 'died', so that the land was lost to the king for ever; Winchester (1278), which tightened up the administration of law and order; and Acton Burnell (1286), which regulated the law relating to trade and merchants.

The bludgeon of the Welsh

Just as Edward wanted to assert his authority at home, so he wanted to extend it into Wales and Scotland – lands which had

1296 – *Winchelsea (centre) disputes with Edward over* Clericis Laicos
(from a contemporary illustration)

for a long time acknowledged the rather vague and undefined overlordship of the king of England. Conflict with Wales was precipitated by the proud and arrogant Prince of Wales, Llewelyn of Gwynedd. He was an old enemy of England and, although he had been at peace since the Treaty of Shrewsbury (1267), he used the opportunity of a new reign to make trouble again. Refusing both to attend Edward's coronation and to do him homage as an overlord, he also ignored a summons to attend the Parliament of 1275.

Edward, regarding Llewelyn as a rebellious vassal, seized Eleanor de Montfort (daughter of Simon de Montfort; see page 1956) on her way to marry Llewelyn, and in 1277 war broke out between England and Wales. At once Edward showed himself a brilliant soldier and a superb commander; his army was well-disciplined, and carried all before it. With his armies retreating and his castles taken one by one, Llewelyn was forced to surrender. The Treaty of Conway, signed in November 1277, brought the war to an end. This Treaty also deprived Wales of an independent prince; however, Edward's son, Edward, was later to begin the tradition by which the king of England's eldest son was proclaimed prince of Wales. Trouble flared up again in 1282 when Llewelyn once more led much of northern Wales in revolt. Again Edward invaded, and again he was victorious. In December 1282 Llewelyn himself was killed, and in April 1283 the revolt was over; the peace terms were embodied in the Statute of Rhuddlan in 1284. There were other revolts in 1286 and 1294, but the pacification of Wales was perhaps Edward's most decisive and enduring achievement.

'The Hammer of the Scots'

Scotland came to the fore in English politics in 1289 when Edward's son was betrothed to the infant Scottish Queen, 'The Maid of Norway'. When she died in 1290 the rival claimants for the Scottish throne presented themselves to Edward, asking him to decide who should be king of Scotland. The strongest claims were those of John Balliol and Robert Bruce; in 1292 Edward decided in Balliol's favour. It was not surprising that many Scottish nobles resented the interference of the King of England in Scottish affairs, and when Edward summoned Balliol to attend his Parliament in 1293, they strongly supported Balliol's decision to refuse. Once more Edward had to assert his authority by force; he postponed preparations for war with France and marched northwards. In April 1296 the Scots were routed at Dunbar; Balliol fled and abdicated his kingdom to Edward. Edward was thus the first king to rule all Britain.

But the peace was short-lived. In 1297 William Wallace led a major revolt, and although this was crushed in 1298, further invasions of Scotland were necessary in 1300, 1301, and 1303. In 1306 came the most serious threat to Edward of all; Robert Bruce, whose grandfather had competed for the throne in 1290, slew his rival John Comyn and had himself proclaimed King of Scotland. This revolt was ultimately to produce that most humiliating of all British defeats – the battle of Bannockburn in 1314. And it was on his way north to deal with Bruce that the ageing but still indomitable Edward died in July 1307 in a military camp on the Scottish border.

War with France and discontent at home

Until 1293 Edward's relations with the greatest of all England's mediaeval enemies, France, had been good. But in that year Philip the Fair of France tried to assert his rights as Edward's feudal overlord. The English king refused a summons to attend the French court, and in 1294 Philip occupied English-owned Gascony.

But Edward's warlike policies were to reap a bitter harvest. The merchants had been repeatedly subjected to the *maltote*, a heavy duty on exported wool; the knights and burgesses had granted taxes in Parliament in 1294, 1295, and 1296, while the Church was also taxed heavily in 1294 and 1295. Resentment grew, and in 1297 the great barons, Hereford and Norfolk, refused to serve abroad in Edward's projected Gascony expedition. Meanwhile the clergy, under the leadership of Winchelsea, the new Archbishop of Canterbury, took their stand on the Papal Bull of 1296 (*Clericis Laicos*), and refused to pay taxation which was not authorised by the Pope. Bitter hostility between the King and the Church was to last almost until the end of the reign; Winchelsea was suspended and exiled in 1306.

Having twice postponed his invasion of France, because of the Welsh and Scottish wars, Edward embarked for France in the summer of 1297. His campaign was a complete failure, and a truce amounting to a *status quo* (unchanged position) was signed with Philip in October 1298. The costly invasion of France was over and Edward had lost the confidence of his subjects. During his absence in 1297 his Regent had been forced to confirm Magna Carta and the Charter of the Forest. This is known as the *Confirmatio Cartarum*; in 1300 Edward himself had to agree to the Confirmation and to the addition of further restricting clauses (*Articuli super Cartas*).

YOU SHOULD NOW KNOW

1. *Who was Llewelyn of Gwynedd?*
2. *What was the 'Model' Parliament?*
3. *When did Edward invade France?*
4. *When did Robert Bruce proclaim himself King of Scotland?*
5. *Which prominent churchman did Edward exile in* 1306?

'The Father of Parliament'

So far we have ignored one of the vital achievements of Edward's reign – the growth of Parliament. This assembly, traditionally called by the king whenever he felt it convenient, was used by Edward to a greater extent than ever before.

Edward summoned his Parliament a great many times because he accepted the principle: 'What touches all must be approved by all'; he wanted Parliament to approve his measures so that he would have the nation's support in his policies. Moreover, when such general questions as taxation were to be discussed, Edward would *sometimes* summon his less important subjects – burghers, knights, and lesser clergy – as well as his traditional confidants, the magnates and higher clergy. In fact, Edward found it useful to do much of his business in Parliament; in doing so he took the nation into his confidence and did much for the future development of Parliament.

The very first Parliament of Edward's reign (1275) agreed to the establishment of a customs duty on wool, which became known as the 'great and ancient custom of the realm'. Most of his famous Statutes were passed in Parliament. The merchants were summoned to Parliament to agree to taxation to pay for Edward's wars. Political executions following the Welsh wars were decided on in Parliament. The Parliament of 1295 included representatives from every class of society and has gone down in history as the 'Model' Parliament.

Finally, we should not forget Edward's achievements in the art of war. The great, and almost untakeable, concentric castles he built in Wales, and his use of the Welsh longbowmen, began a new phase in England's military development.

Edward's famous anger is aroused when a prominent churchman refuses to pay tax

ORGANIC SUBSTANCES

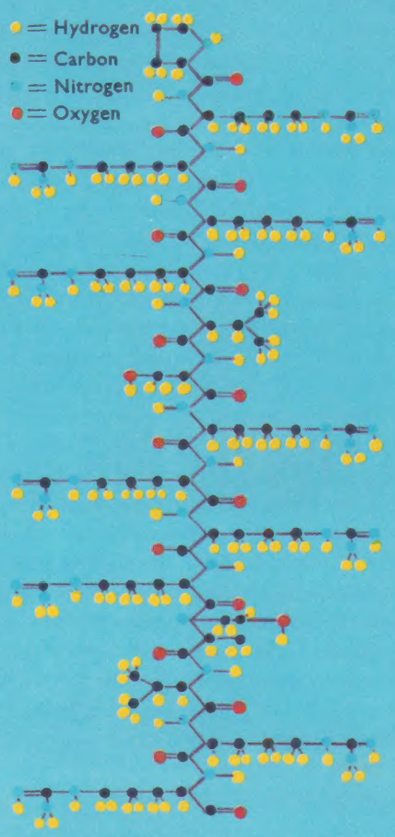
SUPPOSE that one day the radio and newspapers announced that a scientist had made a living mouse using only normal chemicals. Imagine everyone's amazement! Well, the chemists of the 19th century caused nearly as much astonishment. About a century earlier it had been discovered that chemical compounds could be divided into two groups: *organic* and *inorganic* compounds. Inorganic compounds are those which make up all the minerals; organic compounds, on the other hand, are only found in living things. All the 'organisms' of the vegetable and animal kingdoms are formed of these organic chemical compounds. This distinction between organic and inorganic is still valid today, but in the 18th century it was believed that the organic compounds gave 'life' to living things.

The German chemist Friedrich Wöhler (1800-1882)

Berzelius, a great Swedish chemist of the time, declared that organic compounds could only form by means of a mysterious 'vital force' (*vis vitalis*) that was in living things; that chemists could produce inorganic substances in their laboratories, but no one could succeed in producing an organic substance. This 'vital force' theory was exploded in 1828 by the German chemist Wöhler when he announced: 'I must tell you that I can prepare urea without requiring a kidney of an animal, either man or dog.' Urea is an organic substance found in urine, and Wöhler had prepared it from ammonium sulphate and potassium cyanate, both of which can be made from mineral sources. The news of the discovery caused a sensation in the world of science, and the vast field of organic chemistry was opened up for study. The preparation of other organic substances soon followed: in 1835 Liebig synthesised acetaldehyde; in 1835 Cannizzaro made benzyl alcohol; in 1854 Berthelot obtained fats. . . . But this was only the beginning; today there are more than a million organic compounds synthetically (artificially) prepared in laboratories!

WHAT IS AN ORGANIC SUBSTANCE?

It is now known that all organic substances have one feature in common – *they all contain carbon*. This is shown by the fact that they all produce carbon dioxide when burned. Most organic substances contain more than one carbon atom. Carbon atoms have the peculiar property of being able to join together in long chains and rings, and it is this feature which leads to the wide range of organic substances. These chains can vary in length from two or three atoms up to thousands of atoms (see diagrams on right). Organic substances, of course, contain other elements besides carbon; nearly all contain hydrogen, and many contain nitrogen and oxygen. Many other elements can be included in this list; for example, the red colour in blood is due to the presence of iron in a complex organic molecule. Although two organic substances can have the same number of each type of atom, these atoms can often be arranged in several ways. Each arrangement of atoms can make a separate organic substance, with different properties from a substance made up of the same, but differently arranged, atoms.



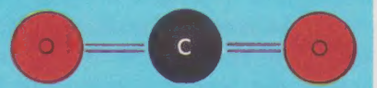
Chain of atoms representing part of the molecule of an organic substance, albumen

Exceptions to the rule are carbonates, cyanides, and carbon dioxide. These contain only one carbon atom and, as they do not form carbon chains, are usually considered to be inorganic substances.

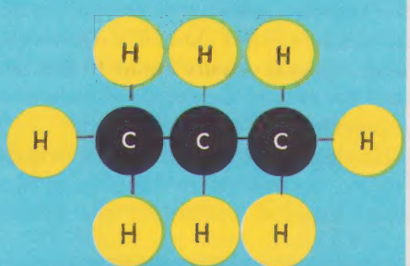
Today the study of *natural products* is becoming very important. These are natural organic substances, as opposed to those which can only be made artificially. It is by studying the properties of these substances that doctors and biologists can learn how our bodies work.

PLASTICS

One of the most important industrial applications of organic chemistry is the production of plastics. All the plastics and man-made fibres in everyday use consist of large organic molecules. Recently, chemists have discovered how to make many small molecules join together (polymerise) to form the large molecules that make plastics. The brittle Bakelite was the first of scores of these modern plastics, which can now be made to do nearly every kind of job.



Symbolic representation of a molecule of carbon dioxide



Propane, a simple organic substance

SOME ORGANIC SUBSTANCES

Citric acid ($C_6H_8O_7$) is found naturally in lemons, a white solid which melts at 153°C

Sucrose ($C_{12}H_{22}O_{11}$) is the main constituent of cane sugar, a colourless solid which melts at about 184°C

Pieces of starch $(C_6H_{10}O_5)_n$ which occur as distinct grains in corn kernels and potatoes

Both sucrose and starch belong to the group of organic compounds called carbohydrates, which also includes gums and cellulose

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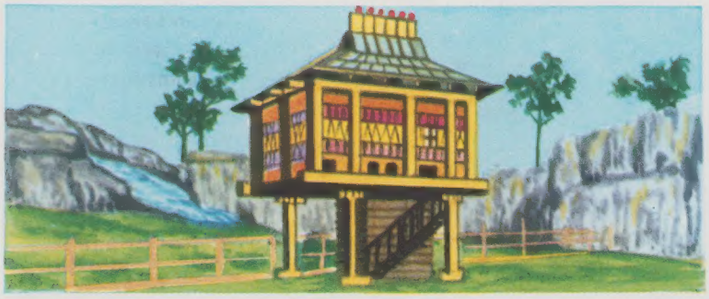

The Slav house

Houses of this type were built for many years by the Slav peoples of Eastern Europe. Like the Russian house, they are designed for some segregation of the sexes, the men living in rather cramped quarters on the ground floor, the womenfolk in relative luxury on the first floor.

The Scandinavian house

Wood is an excellent building material, and where it is plentiful man has made great use of it. Even in the untrimmed state it can be utilised to make log cabins, such as those used by trappers and lumbermen in North America.

Trimmed timber permits the construction of more sophisticated buildings, such as this Norwegian house.

The igloo

In the summer months the Eskimos live in tents, but for the winter they build themselves igloos of snow. The task of building an igloo is usually undertaken by two men, one of whom cuts the blocks while the other sets them in place. The first block to be laid is cut in a wedge shape. Thereafter, the blocks are laid in a spiral manner until the top of the dome is reached. A family igloo is usually about 15 feet in diameter and about 10 feet high.

The entrance to the igloo is either a short tunnel or, in more elaborate homes, one or two small chambers. No provision is made for ventilation, though a small hole may be cut in the ice to form a window, and be covered with a thin sheet of seal gut. The inside walls of the igloo are often covered with seal skin so that the home can be kept warm without melting the ice walls.

THE CONTEMPORARY HOUSE IN BRITAIN

Since Norman times the story of house building in Britain has been one of continuous change and innovation. Certainly there is no British design which, like the igloos of the Eskimos, has remained unchanged for centuries. In most old towns houses can be found which show the various architectural styles of at least the last 250 years. Let us examine the construction of one of the more recent of British houses and see how it compares with that of the traditional houses of other countries.

Foundations

Concrete is almost invariably used for the foundations of modern houses. It is poured into trenches and allowed to set hard before the building of the walls begins. More concrete is used to cover the whole area bounded by the foundations. This layer prevents the growth of vegetation under the house and provides support for the flooring materials used on the ground floor.

Walls

The walls are built upon the foundations. Usually they are of brick, those on the outside being 11 inches thick (that is, the width of two bricks with a 2-inch cavity between) and those on the inside being either 9 inches or 4½ inches, depending upon the weight that they have to carry.

Not less than 6 inches above ground level the brick courses are interrupted by a layer of waterproof material (felt, slate, or plastic) called a *damp-proof course*. The purpose of the damp-proof course is to prevent ground moisture rising through the buried bricks into the rest of the structure.

Roofs

The roofs of modern houses are usually made of tiles or slates, except for flat roofs which are generally made either of concrete or of asphalt. When tiles or slates are used they are attached with copper nails or hoops to horizontal battens fixed to the rafters.

Though waterproof, roofs of tiles and slates are by no means windproof, and so some additional form of protection is necessary. This is usually provided by roofing felt laid on top of the rafters.

Heating

In temperate climates the weather is cold in winter and thus all houses need some form of heating. At one time an open wood or coal fire was used, but the wastefulness of this method and the rising cost of fuel hastened the introduction of more efficient appliances. The closed stove, also burning wood or coal, is an obvious improvement, but many people prefer to abandon fires altogether and to use some form of electrical heating. Equally popular are the 'small-bore' central heating systems in which hot water from a gas, oil, or solid fuel boiler is electrically pumped through narrow (small bore) pipes to radiators in every room.

On the next page is a plan of a typical contemporary house in Britain.

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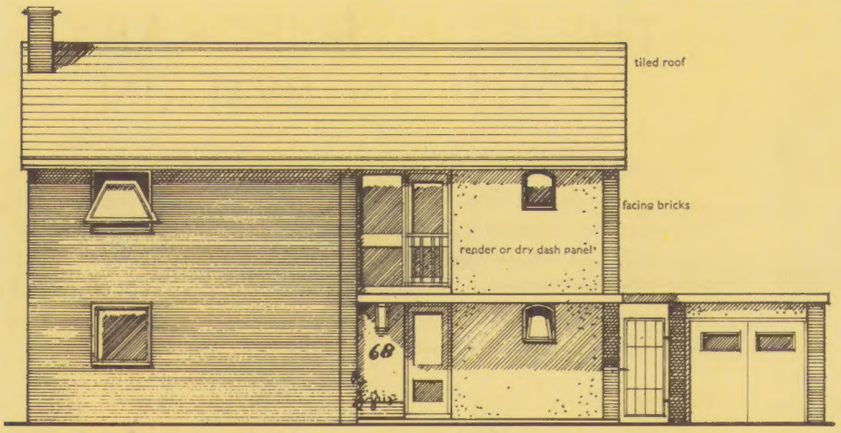
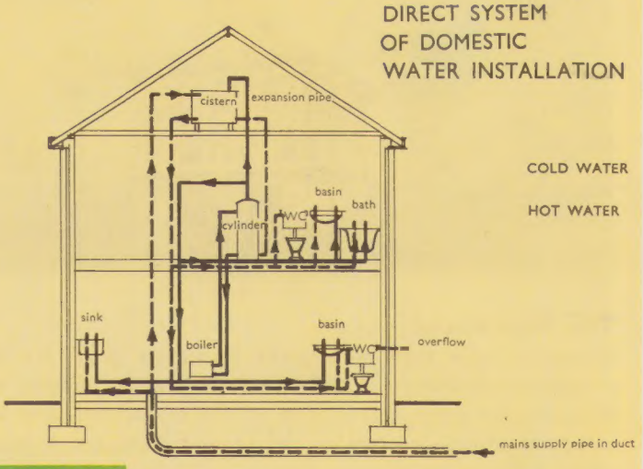
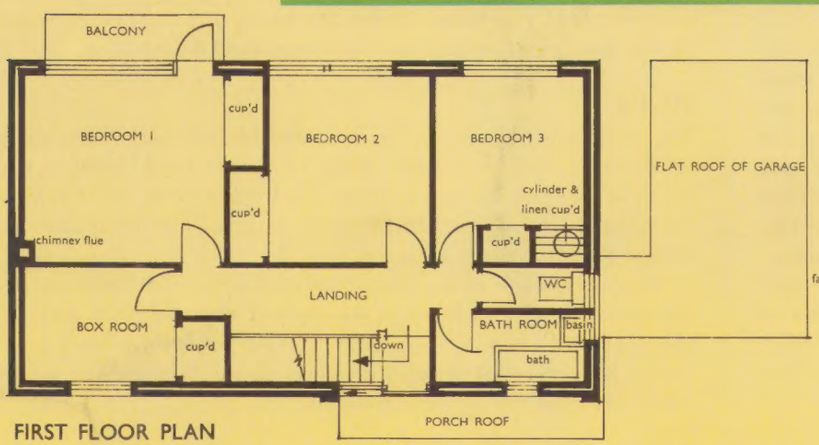


NORTH ELEVATION

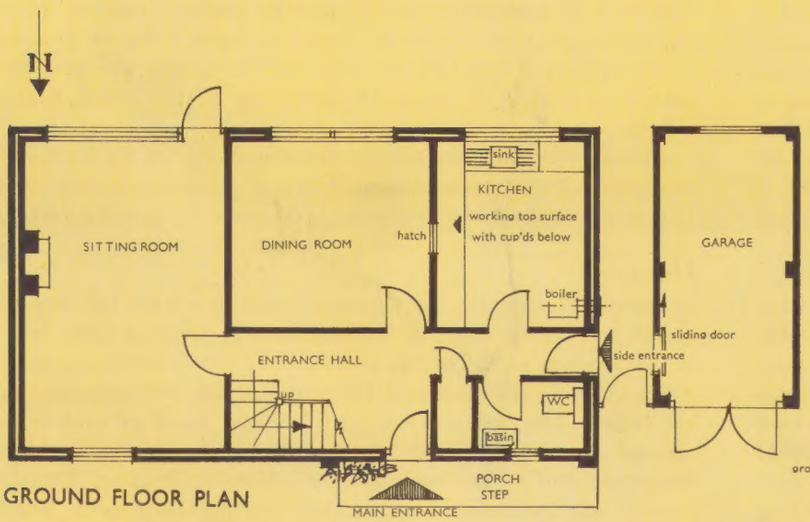
DIRECT SYSTEM OF DOMESTIC WATER INSTALLATION



ARCHITECT'S PLAN FOR A SMALL MODERN HOUSE

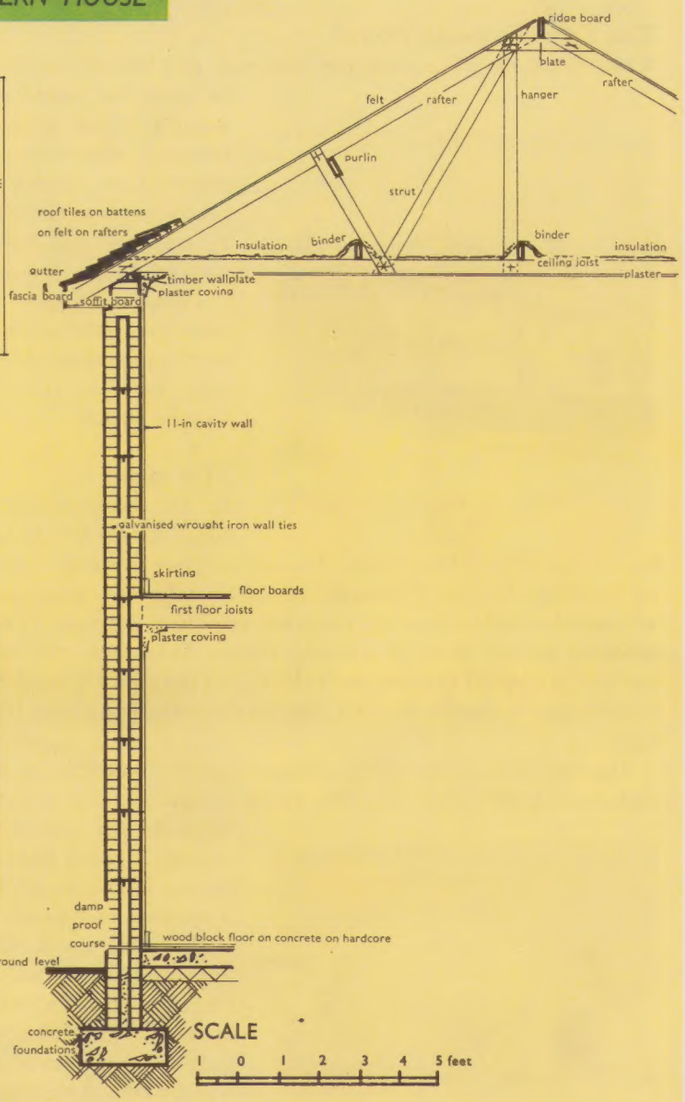


FIRST FLOOR PLAN



GROUND FLOOR PLAN

Scale
5 4 3 2 1 0 5 10 15 20 feet



TYPICAL PART SECTION